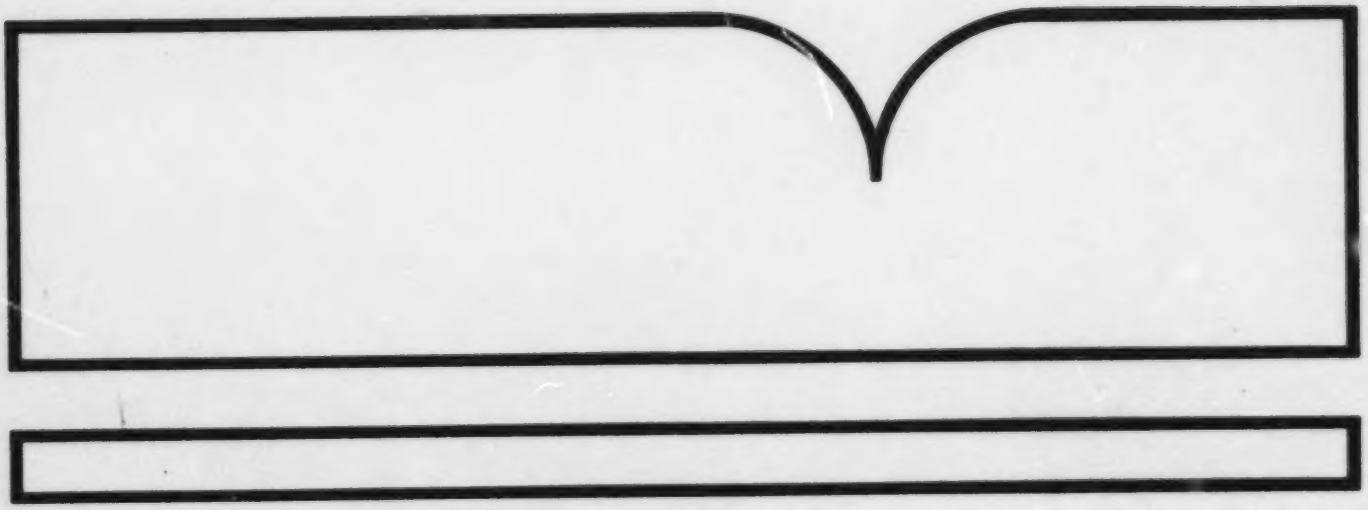
PB81-121956

Comparison of EPA Measured Fuel Economy with the Mileage Guide

(U.S.) Environmental Protection Agency
Ann Arbor, MI

Aug 77



U.S. Department of Commerce
National Technical Information Service
NTIS.

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before complet

1. REPORT NO.	2.	3
EPA-AA-CAB-77-1		PB81-121956

4. TITLE AND SUBTITLE	5. REPORT DATE
Comparison of EPA Measured Fuel Economy with the Mileage Guide	August 1977
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
James A. Rutherford	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
U.S. Environmental Protection Agency Office of Mobile Source Air Pollution Control Characterization and Applications Branch Ann Arbor, Michigan 48105	11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
Same as box 9	Technical
	14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

Data from 842 vehicles (model years 1975-1976) in the Fiscal Year 1975 Emission Factor Program are utilized to examine the differences between fuel economies derived from EPA tests on in-use, consumer owned vehicles and the appropriate values for each vehicle which appear in the Gas Mileage Guides. The discrepancies are examined in terms of absolute differences and percentages. Various vehicle classification, maintenance and utilization factors are investigated to determine their relationship to these discrepancies. The agreement in ranking of vehicles on fuel economy between EF and guide determined economies is also investigated. All analyses are performed on all available vehicles and on the subset of vehicles which pass national standards on HC, CO, NOx emissions.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Fuel consumption Automobiles Motor vehicles Measurement Tests Comparison Maintenance	Fuel economy In-use vehicles	

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
Release unlimited	Unclassified	
	20. SECURITY CLASS *(This page)*	22. PRICE
	Unclassified	

EPA Form 2220-1 (9-73)

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

EPA-AA-CAB-77-1

Comparison of EPA Measured Fuel Economy with the Mileage Guide

James A. Rutherford

August 1977

Characterization and Applications Branch
Emission Control Technology Division
Office of Mobile Source Air Pollution Control
Office of Air and Waste Management
U.S. Environmental Protection Agency

Background

The Gas Mileage Guide presented by EPA in conjunction with FEA is a tool for comparing new cars on the basis of fuel economy. Test sequences which produce the figures for the guide are precisely defined in an effort to provide uniformity in evaluation and more scientifically comparable results. Prototype vehicles at 4,000 miles are driven on a dynamometer by professional drivers in a 75° F environment. Starting, stopping, acceleration, and deceleration within the city and highway cycles are intended to be representative of these modes of operation by consumers.

It would not be expected that an owner calculating gas mileage for his car would get the exact figure shown in the guide although the discrepancy should not be too great. The difference between an owner determined gas mileage and the guide value may be considered to contain two major components. The first is the difference between the owner's determination of gas mileage and the figures that would result if his car were put through the test sequences used by EPA. These differences include the specific type of driving, the ambient temperature, the vehicle engine temperature, etc. The second is the difference between these tests run on the consumer's in-use vehicle and the published figures in the guide for that specific type of vehicle. These differences include prototype/ production differences as well as differences in specific vehicle configuration such as axle ratio, test weight, tires, etc. This report will focus upon the second of the two components.

Data

Data utilized in this report come from the Fiscal Year 1975 Emission Factor Program. The program includes testing of 2200 vehicles from 1966 through 1976 model years. Consumer owned, in-use vehicles were selected in seven cities based upon sales weighting for the determination of make and model and based upon vehicle miles traveled for the determination of model year characteristics. Information in this report is based upon the model years 1975 and 1976.

City fuel economy is calculated for each vehicle from data obtained in the 1975 Federal Test Procedure via the carbon balance method. Highway fuel economy results were obtained on a subset of the vehicles via the Federal Highway Fuel Economy Test. Various classification parameters (e.g., engine size, transmission type, etc.) were recorded at reception of the vehicle for testing. The vehicle owners were asked to complete a questionaire which included information about vehicle use and maintenance. Of 842 model year 1975 and 1976 vehicles included in FY75 EFP, 235 had Highway Fuel Economy Tests performed. City and highway fuel economies as they appear in the 1975 and 1976 Gas Mileage Guides were used for all but thirty of the vehicles which could not be located in the guides.

Approach

In examining the discrepancies between EF values and guide values for fuel economy, the prima facie approach would be to consider one value minus the other. However, a difference of 3 miles per gallon would probably be more important when dealing with values around 8 miles per gallon than around 30 miles per gallon. This would lead to a consideration of some relative measure. In this report it is assumed that both absolute and relative measures are of interest. The analyses are performed with both types of measures thus providing the possibility of determining whether they lead to consistent conclusions.

Absolute differences were calculated as Emission Factor values minus Gas Mileage Guide values (i.e., the result from HFET minus the guide highway fuel economy and the result from FTP minus the guide city fuel economy for each vehicle). Relative measures were calculated as EF value as percent of guide value (i.e., HFET divided by guide highway fuel economy multiplied by 100 and FTP divided by guide city fuel economy multiplied by 100). Thus, if the EF value were less than the guide value the difference would be negative and the percent would be something less than 100, if the EF value were equal to the guide value the difference would be zero and the percent 100, and if the EF were greater than the guide value the difference would be positive and the percent something greater than 100.

That the resultant differences were not all zero and that there was a great deal of variability will be presented later. Beyond the overall results it is of interest to determine whether the differences show any systematic relationship to various vehicle classification and maintenance factors. Due to the nature of the measurements being utilized, normal theory statistical approaches do not seem appropriate. The non-parametric method of choice for determining whether vehicle classification and maintenance factors have significant statistical effects upon the EF/guide fuel economy differences and percents is the analysis of variance test applied to ranks (termed the Kruskall-Wallis test).

In light of the stipulated purpose of the Fuel Economy Guide being the comparison of vehicles, it is also of interest to consider the question of how the ranking of the fuel economies of vehicles compares between EF and guide values. For this purpose a nonparametric correlation measure is utilized. Due to the large number of tied observations the Goodman - Kruskal Gamma is used rather than the more frequently seen Kendall's Tau. The G-K Gamma is similar to a normal theory correlation coefficient in that its possible values range from -1 to +1. As in normal theory a value of zero indicates independence while values approaching +1 indicate strong agreement. From the G-K Gamma an estimate of the probability of concordance is calculated where the probability of concordance is defined as the probability that, for two vehicles drawn at random from the appropriate stratum, if one of the measures ranks one vehicle above the other then the other measure will rank them in the same order.

The interaction of fuel economy and regulated emissions has been a topic of much interest as a result of increasing demand for fuel and more stringent regulations. The analysis of fuel economies in this report are duplicated for that subset of vehicles which are within the national stipulated limits for new cars on HC, CO and NOx for model years 1975 and 1976.

Results

Of the 842 1975 and 1976 model year vehicles in the data, 398 were within the emission limits for HC, CO and NOx. Thirteen of these passed vehicles were among the original thirty not appearing in the Gas Mileage Guides.

Percents (EF as percent of guide value) and differences (EF minus guide value) were calculated for each available vehicle for highway and city fuel economies. A rough presentation of the results of these calculations appears in Table 1. Using the arbitrary figures of a difference of less than two or within ten percent as non-significant differences it is seen that about thirty percent of these vehicles have significantly lower EF values than guide values on the highway cycle and 10 to 20 percent on the city cycle. Less than ten percent of the vehicles have significantly higher EF values on both cycles.

As will be seen throughout there is general concurrence of results both between percents and differences and between all vehicles and passed vehicles. However, as seen in Table 2, there is quite a bit of disagreement between city and highway cycles for the same vehicle. For example, of the 67 vehicles in the less than 90% group on the highway cycle, only 37 of these vehicles are in the less than 90% group for the city cycle.

Tables 3 and 4 give the medians and means for the differences and percents by the various factors under investigation. Table 3 includes all available data while Table 4 presents results for those vehicles which were within the limits set by Federal regulations on HC, CO and NOx emissions. The asterisks (*) indicate the Kruskal-Wallis tests which achieved the nominal 0.01 significance level for testing whether the factor in question has any relationship to the measure in question. For example, in Table 3 the asterisks following "Site" indicate that "site" has a significant effect upon both percents and differences for the city cycle but for neither on the highway cycle. That is, on the city cycle, the city in which a vehicle was operated affected the vehicle's relative in-use/guide fuel economy. These two tables will be summarized by factor headings below:

All Vehicles: The overall medians and means appear for all vehicles in Table 3 and for all passed vehicles in Table 4.

Site: For both groups of vehicles site was a significant factor on the city cycle but not on the highway cycle. It appears that vehicles in Houston had lower EF values for the city cycle relative to the guide than other cities.

Model Year: The city cycle showed significant differences for model year for both groups of vehicles. Model year 1975 vehicles had higher EF values relative to the guide than 1976 model year vehicles. There was an insufficient number of model year 1975 vehicles with Highway Fuel Economy Tests to make an adequate comparison on the highway cycle.

Model Size: All tests were significant based upon model size. Subcompacts had lower EF values relative to the guide than other vehicles.

Cylinders: All tests were significant for number of cylinders. Four cylinder vehicles had lower EF values relative to the guide than other vehicles. On each measure it appears that the vehicles generally are in the ordering four cylinders, six cylinders, eight cylinders from least to greatest.

Carb Venturis: Only the test for highway differences on passed vehicles turned out significant. This might be considered a spurious result since the same test on all vehicles which showed the same general trend with a larger sample did not show significance.

CID: All tests were significant for engine size as measured in cubic inches displacement. The smallest engine size category, 0-150, showed lower EF values relative to the guide than larger engine size vehicles.

Transmission: All tests were significant when comparing manual transmission vehicles with automatics. Manual transmission vehicles showed lower EF values relative to the guide than automatics.

Manufacturer: Manufacturer was a significant factor by all tests. Vehicles in the "Other" category (not AMC, Chrysler, Ford, or GM) had lower EF values relative to the guide than vehicles in the other categories.

Catalyst: For both groups of vehicles presence of catalyst only appeared as a significant factor for highway differences. Those vehicles which had no catalyst showed lower EF values relative to guide values for highway differences than vehicles with catalyst.

Primary Use: None of the tests showed significance for usual load.

Maintained According to Manufacturer's Recommendation?: None of the tests showed significance for this factor.

Satisfied with Engine Performance?: This factor turned out significant for both percents and differences on the highway cycle for the group consisting of all avaliable vehicles. Those vehicles for which the owner answered "yes" to the question were in the middle with "no" below and "most of the time" above for EF values relative to guide values.

How Often Tuned?: This factor showed significant effect for all vehicles on the city cycle. Vehicles with owners answering that their vehicles were tuned less often than once per year had higher EF values relative to guide values.

Last Tune?: This factor turned out significant for both groups of vehicles on the city cycle for both percents and differences. Vehicles owned by people who answered that the last tune was more than a year previous had higher EF values relative to the guide than other vehicles. Note that this result as well as the above result concerning the frequency of tune could be confounded with the effect of model year.

Who Tuned?: Only the percents on the city cycle for the group consisting of all available vehicles showed significant effects from this factor. This should probably be considered non-meaningful significance since there appears to be little range in the medians and means.

Mileage Group: Both groups of vehicles showed significance on both tests for the city cycle while none of the tests for the highway cycle were significant. It appears that for the city cycle vehicles with low mileage have low EF values with respect to guide values and as mileage increases EF values approach guide values. No such trend is observed on the highway cycle.

Although all four measures (city percents, city differences, highway percents and highway differences) appear to be slightly lower for the group consisting of passed vehicles than for the entire group of vehicles, Kruskal-Wallis tests for differences between the group of vehicles which passed and the group which didn't were far from significant for all four measures. As observed above, the tests on the two groups of vehicles lead to generally consistant results.

Tables 5 and 6 present the results of the calculations of the Goodman-Kruskal Gamma and an estimate of the probability of concordance for appropriate groups. These measure the agreement in ranking between Emission Factor test values and Gas Mileage Guide values. The Goodman-Kruskal Gamma is similar to a correlation coefficient ranging from -1 to +1 and the probability of concordance is the probability that two

vehicles drawn at random from the appropriate group would be ranked in the same order by the two determinations of fuel economy. Thetables stratified by vehicle size groups since these groups correspond to the current organization of Gas Mileage Guide and they form a breakdown which would be practical for a consumer considering the purchase of a new vehicle. It is seen that for larger groupings (all vehicles, all 1976 vehicles, etc.) the probability of concordance and the G-K Gamma is larger than for the more discrete breakdowns. This is reflective of the fact that the smaller groups are fairly homogeneous within while a large degree of heterogeneity exists between the groups. These measures are of the same order of magnitude and generally show the same trends when comparing the two groups of vehicles (passed vehicles and all vehicles).

Conclusions

Based on all avilable data, 68% and 88% of vehicles had Emission Factor fuel economies within 2 miles per gallon of Gas Mileage Guide fuel economies for the highway cycle and city cycle respectively. In terms of relative fuel economies, 67% (highway) and 74% (city) of these vehicles had Emission Factor fuel economies within ten percent of the guide values. Twenty-eight percent on highway and ten percent on city had EF fuel economies more than 2 miles per gallon less than the guide values. Twenty-nine percent and eighteen percent for highway and city respectively had EF fuel economies that were less than ninety percent of guide values. The results for the group of vehicles which were within emission standards were very close to the above.

Those vehicles which generally have relatively high fuel economies (e.g., vehicles with engines smaller than 150 CID) showed EF fuel economies lower than other vehicles relative to the guide values. Vehicles which had the least maintenance appeared to have higher EF economies relative to guide values. However, the significance of this is uncertain since the quality of the received maintenance is not known. It could imply that the "maintenance" consisted of carburetor adjustment which was detrimental to fuel economy. On the city cycle vehicles with low mileage have low EF fuel economies relative to guide values and as mileage increases EF values approach guide values.

The difference between the total group of vehicles in the analyses and that subset of vehicles which were within emission standards is essentially insignificant.

Table 1

Number and Percent of Vehicles
in Difference and Percent Groups

	All Vehicles				Passed Vehicles			
	Highway		City		Highway		City	
	N	%	N	%	N	%	N	%
Total	231	100	812	100	132	100	385	100
Differences								
< -2	65	28	78	10	41	31	46	12
-2 to +2	157	68	712	88	88	67	328	85
> +2	9	4	22	2	3	2	11	3
Percents								
< 90	67	29	143	18	40	30	72	19
90-110	154	67	601	74	89	67	279	72
> 110	10	4	68	8	3	3	34	9

Table 2

Number of Vehicles Cross-Classified
by Highway and City Groups

	Highway					
	All Vehicles			Passed Vehicles		
Differences	<-2	-2 to +2	>+2	<-2	-2 to +2	>+2
< -2	37	3	0	23	2	0
-2 to +2	30	153	9	17	85	3
> +2	0	1	0	0	1	0

City

Percents	< 90	90 - 110	> 110	< 90	90 - 110	> 110
< 90	37	24	0	22	14	0
90 - 110	29	126	5	17	71	1
> 110	1	4	5	1	4	2
	67					

Table 3

Medians and Means of Percents and Differences by Factors
All Vehicles (* indicates nominal significance for
appropriate Kruskal-Wallis test)

	Highway					City			
	N	Percents		Differences		N	Percents		Differences	
		Median	Mean	Median	Mean		Median	Mean	Median	Mean
All Vehicles	231	94	94	-1.3	-1.7	812	97	98	-.5	- .5
Site							*		*	
Chicago	43	99	97	- .3	- .9	208	98	98	- .3	- .4
Denver	43	94	94	-1.5	-1.7	75	99	100	- .1	- .2
Houston	43	93	93	-1.4	-1.9	77	93	94	-1.0	-1.1
Los Angeles	43	90	90	-2.0	-2.5	78	98	101	- .2	.0
St. Louis	13	92	92	-2.0	-2.4	104	95	95	- .7	-1.0
Washington	44	96	96	-1.0	-1.3	79	96	97	- .6	- .7
Phoenix	2	102	102	.7	.7	191	98	98	- .3	- .4
Model Year							*		*	
1975	1	102	102	.5	.5	273	100	103	.1	.2
1976	230	94	95	-1.3	-1.7	539	95	95	- .7	- .9
Model Size		*		*			*		*	
Full Size	29	96	96	- .7	- .8	150	97	97	- .4	- .4
Intermediate	49	97	97	- .6	- .7	197	99	99	- .2	- .1
Compact	51	95	97	-1.0	- .7	178	98	98	- .3	- .4
Subcompact	49	89	88	-3.7	-4.1	196	94	94	-1.4	-1.4
Truck	51	93	92	-1.4	-1.9	89	99	102	- .2	- .1

Table 3 (con't)

	Highway					City				
	N	Percents		Differences		N	Percents		Differences	
		Median	Mean	Median	Mean		Median	Mean	Median	Mean
Cylinders		*		*			*		*	
Four	55	89	88	-3.9	-4.1	185	93	94	-1.6	-1.5
Six	47	93	93	-1.6	-1.6	133	97	97	- .5	- .5
Eight	128	96	99	- .7	- .7	491	98	99	- .2	- .1
Carb Venturis										
One	52	94	94	-1.4	-1.6	134	97	98	- .5	- .5
Two	133	92	93	-1.6	-2.0	496	97	98	- .5	- .5
Four	40	97	97	- .5	- .7	159	97	97	- .4	- .4
Fuel Injection	6	93	94	-2.6	-2.0	18	97	98	- .5	- .4
CID		*		*			*		*	
0-150	55	89	88	-3.9	-4.1	187	93	94	-1.6	-1.5
151-250	36	93	94	-1.4	-1.3	110	97	98	- .5	- .4
251-330	47	95	95	-1.2	-1.2	145	99	100	- .1	- .1
331-399	62	98	97	- .4	- .5	245	99	100	- .2	.0
400	31	96	96	- .7	- .8	125	96	96	- .5	- .5
Transmission		*		*			*		*	
Automatic	175	95	96	- .9	- .9	642	98	98	- .3	- .3
Manual	56	88	88	-3.9	-4.0	170	94	95	-1.1	-1.2

Table 3 (con't)

	Highway					City			
	N	Percents		Differences		N	Percents		Differences	
		Median	Mean	Median	Mean		Median	Mean	Median	Mean
Manufacturer		*		*			*		*	
AMC	5	95	98	-1.0	- .5	22	100	99	- .1	- .2
Chrysler	32	94	97	-1.2	- .7	108	98	98	- .3	- .4
Ford	57	92	93	-1.6	-1.7	194	96	99	- .6	- .4
GM	101	97	96	- .7	-1.0	364	98	98	- .3	- .3
Other	36	88	87	-4.0	-4.5	124	94	94	-1.5	-1.5
Catalyst				*						
Yes	198	94	94	-1.1	-1.5	700	97	98	- .4	- .4
No	33	91	93	-3.0	-2.7	112	97	97	- .7	- .9
Primary Use										
Driver only	145	94	93	-1.4	-1.8	518	97	98	- .5	- .5
Driver & 1 passenger	48	96	96	- .8	-1.1	186	98	98	- .3	- .5
Driver & 2 passengers	28	92	91	-1.5	-2.1	76	95	96	- .7	- .8
Maintained According to Mfg. Rec.?										
Yes	224	94	94	-1.4	-1.7	772	97	97	- .5	- .5
No	2	103	103	.6	.6	15	99	110	- .2	1.0
Not sure	4	94	95	-1.4	-1.6	19	100	97	.0	- .8

Table 3 (con't)

	Highway					City				
	N	Percents		Differences		N	Percents		Differences	
		Median	Mean	Median	Mean		Median	Mean	Median	Mean
Satisfied with Engine Performance?		*		*						
Yes	183	93	93	-1.5	-1.8	658	97	98	- .4	- .5
Most of the Time	31	99	99	- .2	- .4	96	98	98	- .3	- .3
No	17	91	90	-1.8	-2.4	58	95	95	- .8	- .9
How often tuned?							*		*	
Not yet	160	94	94	-1.2	-1.5	400	96	96	- .6	- .7
Mfg. Rec	30	92	90	-2.0	-2.7	118	97	98	- .4	- .5
6 Months	21	93	93	-1.4	-2.0	153	98	98	- .3	- .4
Year	15	95	94	-1.0	-1.5	106	99	100	- .1	- .1
Less often	1	101	101	.2	.2	17	100	109	.0	.8
Don't know	4	99	96	- .2	- .9	18	96	98	- .5	- .4
Last tune?							*		*	
Too new	168	94	94	-1.2	-1.5	397	96	96	- .6	- .7
Due, not done	12	94	94	-1.7	-1.6	59	98	99	- .3	- .3
0-6 months	45	93	92	-1.9	-2.3	273	98	98	- .3	- .4
6-12 months	2	85	85	-3.4	-3.4	42	100	99	.0	- .3
Over 1 year	0	--	--	---	---	19	101	109	.1	.9
Don't know	4	99	96	- .2	- .9	22	98	99	- .3	- .1

Table 3 (con't)

	Highway					City			
	N	Percents		Differences		N	Percents		Differences	
		Median	Mean	Median	Mean		Median	Mean	Median	Mean
Who tuned?								*		
None	180	94	94	-1.2	-1.5	451	96	97	- .6	- .7
Dealer	37	92	91	-2.0	-2.5	189	98	99	- .3	- .4
Indep. Garage	4	93	93	-1.5	-1.8	79	98	99	- .2	- .2
Clinic	0	--	--	---	---	15	96	97	- .5	- .6
Self	6	99	95	- .3	-2.0	51	98	99	- .2	- .3
Don't know	4	99	96	- .2	- .9	27	99	104	- .2	.3
Mileage Group								*		*
< 4K	53	92	93	-1.7	-2.0	100	93	93	-1.0	-1.3
4K-10K	95	95	94	-1.1	-1.7	233	96	96	- .6	- .7
10K-20K	66	93	94	-1.5	-1.7	289	98	99	- .3	- .4
20K-30K	12	97	97	- .5	- .5	141	99	100	- .1	- .1
> 30K	5	91	94	-1.9	-1.7	49	99	100	- .1	- .1

Table 4

Medians and Means of Percents and Differences by Factors Passed Vehicles (* indicates nominal significance for appropriate Krusal-Wallis test)

	Highway					City			
	N	Percents		Differences		N	Percents		Differences	
		Median	Mean	Median	Mean		Median	Mean	Median	Mean
All Vehicles	132	93	93	-1.5	-1.9	385	96	97	- .6	- .6
Site							*		*	
Chicago	25	96	96	- .7	-1.3	95	97	98	- .3	- .5
Denver	25	93	93	-1.8	-1.8	39	99	100	- .1	- .1
Houston	25	93	92	-1.4	-2.1	40	91	92	-1.0	-1.4
Los Angeles	24	90	91	-2.1	-2.3	40	97	99	- .3	- .3
St. Louis	6	84	85	-4.5	-4.6	41	94	94	- .8	-1.2
Washington	25	95	95	-1.2	-1.5	41	94	97	- .9	- .7
Phoenix	2	102	102	.7	.7	89	98	98	- .3	- .4
Model Year							*		*	
1975	1	102	102	.5	.5	110	102	103	.3	.3
1976	131	93	93	-1.6	-1.9	275	95	95	- .8	- .9
Model Size		*		*			*		*	
Full Size	18	96	95	- .8	- .8	67	95	96	- .7	- .5
Intermediate	32	94	94	-1.2	-1.1	82	97	97	- .5	- .4
Compact	25	95	98	-1.1	- .5	84	99	100	- .1	- .1
Subcompact	35	87	87	-4.4	-4.6	108	94	94	-1.6	-1.5
Truck	20	98	96	- .4	-1.2	42	99	101	- .1	.1

Table 4 (con't)

	Highway					City			
	N	Percents		Differences		N	Percents		Differences	
		Median	Mean	Median	Mean		Median	Mean	Median	Mean
Cylinders		*		*			*		*	
Four	36	88	88	-4.2	-4.4	102	94	94	-1.7	-1.5
Six	28	93	94	-1.5	-1.3	69	98	98	- .4	- .4
Eight	67	96	96	- .7	- .8	213	98	99	- .3	- .2
Carb Venturis				*						
One	27	95	95	-1.1	-1.0	61	98	98	- .4	- .5
Two	67	91	91	-2.0	-2.8	233	97	98	- .6	- .6
Four	32	97	96	- .6	- .7	79	96	96	- .6	- .5
Fuel Injection	6	93	96	-2.6	-2.0	10	95	96	- .8	- .7
CID		*		*			*		*	
0-150	36	88	88	-4.2	-4.4	102	94	94	-1.7	-1.5
151-250	25	93	95	-1.4	-1.0	60	99	98	- .2	- .3
251-330	12	94	93	-1.4	-1.6	55	100	101	- .1	- .1
331-399	42	97	96	- .7	- .7	116	98	98	- .3	- .2
400	17	96	95	- .7	- .7	52	94	95	- .8	- .7
Transmission		*		*			*		*	
Automatic	98	95	95	- .9	-1.1	299	97	98	- .5	- .4
Manual	34	90	88	-3.8	-4.2	86	94	95	-1.2	-1.3

Table 4 (con't)

	Highway				City			
	N	Percents		Differences	N	Percents		Differences	
		Median	Mean	Median	Mean		Median	Mean	Median	Mean
Manufacturer		*		*		*		*	
AMC	0	--	--	--	--	4	97	95	- .5	-1.2
Chrysler	10	102	101	.4	.2	20	99	99	- .1	- .3
Ford	36	92	92	-1.7	-1.8	116	94	97	- .8	- .6
GM	56	96	96	- .7	- .9	171	98	99	- .3	- .2
Other	30	89	88	-3.9	-4.4	74	94	94	-1.6	-1.5
Catalyst				*						
Driver Only	80	93	93	-1.5	-2.0	244	97	98	- .5	- .5
Driver & 1 passenger	28	95	96	- .8	-1.4	87	96	97	- .5	- .6
Driver & 2 passengers	17	91	91	-1.8	-2.3	39	94	95	- .9	-1.0
Maintained According to Mfg. Rec?										
Yes	127	93	93	-1.6	-1.9	364	96	97	- .6	- .6
No	1	99	99	- .3	- .3	10	99	102	- .1	- .2
Not Sure	4	94	95	-1.4	-1.6	10	93	94	-1.0	-1.3
Satisfied with Engine Performance?										
Yes	106	93	93	-1.7	-2.0	321	96	97	- .6	- .6
Most of the time	17	99	98	- .3	- .5	40	97	98	- .4	- .4
No	9	89	88	-2.4	-2.9	24	94	94	-1.0	-1.1

Table 4 (con't)

	Highway					City			
	N	Percents		Differences		N	Percents		Differences	
		Median	Mean	Median	Mean		Median	Mean	Median	Mean
How often tuned?										
Not yet	86	93	94	-1.5	-1.7	192	96	96	- .7	- .8
Mfg. Rec.	19	93	91	-2.0	-2.6	64	97	96	- .6	- .7
6 months	14	92	91	-2.0	-2.7	69	97	98	- .5	- .4
Year	10	94	94	-1.1	-1.6	45	98	99	- .3	- .2
Less often	0	--	--	---	---	6	111	109	1.6	.9
Don't know	3	100	95	.0	-1.0	9	94	98	- .7	- .3
Last tune?							*		*	
Too new	93	93	94	-1.3	-1.6	192	95	95	- .8	- .9
Due, not done	8	94	94	-1.7	-1.7	34	100	94	.0	.1
0-6 months	27	92	90	-2.0	-3.0	126	97	98	- .5	- .5
6-12 months	1	102	102	.5	.5	14	100	97	.0	- .6
Over 1 year	0	--	--	---	---	7	111	110	1.3	1.1
Don't konw	3	100	95	.0	-1.0	12	100	100	.0	.1
Who tuned?										
None	101	93	94	-1.4	-1.6	224	96	96	- .7	- .8
Dealer	23	93	91	-2.0	-2.7	89	98	98	- .3	- .4
Indep. Garage	1	83	83	-5.4	-5.4	34	97	99	- .3	- .3
Clinic	0	--	--	---	---	4	97	95	- .4	- .8
Self	4	97	93	-1.6	-3.0	22	97	98	- .5	- .5
Don't know	3	100	95	.0	-1.0	12	100	100	.0	.1

Table 4 (con't)

	Highway				City			
	N	Percents		Differences	N	Percents		Differences
		Median	Mean	Median Mean		Median	Mean	Median Mean
Mileage Group						*		*
< 4K	30	92	93	-1.7 -2.0	58	93	93	-1.0 -1.2
4K-10K	50	93	93	-1.8 -2.0	103	94	96	- .9 - .8
10K-20K	40	93	93	-1.7 -2.0	141	97	98	- .5 - .4
> 20K	12	100	97	- .1 - .8	83	99	99	- .1 - .3

Table 5

Goodman-Kruskal Gamma and the
Probability of Concordance---All Vehicles

Model Year	Model Size	HIGHWAY n	HIGHWAY gamma	HIGHWAY p	CITY n	CITY gamma	CITY p
both	All	231	.7638	.8819	812	.8172	.9086
1975	All	1	-----	-----	273	.7730	.8865
"	Fullsize				65	.7328	.8664
"	Intermediate				56	.5394	.7697
"	Compact				48	.5875	.7938
"	Subcompact				65	.6962	.8481
"	Truck				38	.3239	.6620
1976	All	230	.7632	.8816	539	.8585	.9293
"	Fullsize	29	.5700	.7850	85	.6873	.8437
"	Intermediate	49	.4513	.7065	141	.6742	.8371
"	Compact	50	.7333	.8667	130	.6889	.8444
"	Subcompact	49	.6927	.8464	131	.7219	.8610
"	Truck	51	.5389	.7695	51	.8010	.9005

Table 6

Goodman-Kruskal Gamma and the
Probability of Concordance---Passed Vehicles

Model Year	Model Size	HIGHWAY n	HIGHWAY gamma	HIGHWAY p	CITY n	CITY gamma	CITY p
both	All	132	.7853	.8765	385	.8156	.9078
1975	All	1	-----	-----	110	.7779	.8890
"	Fullsize				19	.7458	.8729
"	Intermediate				10	.2500	.6250
"	Compact				21	.6647	.8324
"	Subcompact				37	.7539	.8770
"	Truck				22	.1034	.5517
1976	All	131	.7847	.8924	275	.8699	.9350
"	Fullsize	18	.5046	.7523	48	.6758	.8379
"	Intermediate	32	.5253	.7627	72	.7709	.8855
"	Compact	25	.6637	.8319	63	.6446	.8223
"	Subcompact	35	.7036	.8518	71	.6870	.8435
"	Truck	20	.3467	.6734	20	.6508	.8254

Abstract

Data from 842 vehicles (model years 1975-1976) in the Fiscal Year 1975 Emission Factor Program are utilized to examine the differences between fuel economies derived from EPA tests on in-use, consumer-owned vehicles and the appropriate values for each vehicle which appear in the Gas Mileage Guides. The discrepancies are examined in terms of absolute differences and percentages. Various vehicle classification, maintenance and utilization factors are investigated to determine their relationship to these discrepancies. The agreement in ranking of vehicles on fuel economy between EF and guide determined economies is also investigated. All analyses are performed on all available vehicles and on the subset of vehicles which pass national standards on HC, CO and NOx emissions.